

Feel the Burn

By Pearl Tesler

The article "The Amazing Race" describes the incredible endurance of the sled dogs that run the grueling Iditarod every year in Alaska. Like people, the dogs derive their energy from structures in their cells called *mitochondria*.

Mitochondria release energy in two different ways—*aerobically* (with oxygen) and *anaerobically* (without oxygen). When muscles are working so hard that they run out of oxygen, they make the switch from aerobic to anaerobic energy production.

See and feel that switch take place in your own muscles by doing this two-minute finger workout. It won't make you fit enough to run the Iditarod, but it will teach you about your muscles.

What You Need

- a clothespin (the kind with a metal spring)
- a watch

What to Do

1. Hold the clothespin between your thumb and index finger.
2. Count the number of times you can open and close the clothespin in one minute. Go as fast as you can.
3. When the minute is over, don't stop! Keep going for another minute, working as fast as you can. How many times could you open and close the clothespin during the first minute compared with the second minute? How did your fingers feel at the end of two minutes?

What Happens

A clothespin workout might seem wimpy, but your fingers probably tired out pretty quickly. Most likely you were able to pinch the clothespin many more times in the first minute than in the second. You probably felt a burning sensation develop in your muscles too. Why did fatigue set in so fast?

When you first started pinching the clothespin, your muscles had plenty of oxygen available to them. That oxygen allowed the mitochondria in your muscle cells to produce energy aerobically, via *cellular respiration*, a complicated chemical reaction that uses oxygen and *glucose* (blood sugar from digested food) to produce energy.

As you kept pinching, however, your muscles used up oxygen faster than it could be replaced. When the oxygen in your muscles began to run out, your muscles switched to anaerobic energy production. At that point, your muscle cells still consumed glucose but used a different chemical reaction that doesn't require oxygen. A by-product of that chemical reaction is *lactic acid*. A buildup of lactic acid is what made your muscles "feel the burn."

